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XIV. *Observations on the Grafting of Trees. In a Letter from Thomas Andrew Knight, Esq. to Sir Joseph Banks, Bart. P. R. S.*

Read April 30, 1795.

SIR,

I AM encouraged to address the following letter to you, by the opinion you were last year pleased to express of part of my experiments and observations, on the diseases and decay of those varieties of the apple and pear which have been long in cultivation. The disease from whose ravages they suffer most is the canker, the effects of which are generally first seen in the winter, or when the sap is first rising in the spring. The bark becomes discoloured in spots, under which the wood, in the annual shoots, is dead to the centre, and in the older branches, to the depth of the last summer's growth. Previous to making any experiments, I had conversed with several planters, who entertained an opinion, that it was impossible to obtain healthy trees of those varieties which flourished in the beginning and middle of the present century, and which now form the largest orchards in this country. The appearance of the young trees, which I had seen, justified the conclusion they had drawn ; but the silence of every writer on the subject of planting, which had come in my way, convinced me that it was a vulgar error, and the following experiments were undertaken to prove it so.

I suspected that the appearance of decay in the trees I had seen lately grafted, arose from the diseased state of the grafts, and concluded, that if I took scions or buds from trees grafted in the year preceding, I should succeed in propagating any kind I chose. With this view I inserted some cuttings of the best wood I could find in the old trees, on young stocks raised from seed. I again inserted grafts and buds taken from these on other young stocks, and wishing to get rid of all connection with the old trees, I repeated this six years; each year taking the young shoots from the trees last grafted. Stocks of different kinds were tried, some were double grafted, others obtained from apple-trees which grew from cuttings, and others from the seed of each kind of fruit afterwards inserted on them; I was surprised to find that many of these stocks inherited all the diseases of the parent trees.

The wood appearing perfect and healthy in many of my last grafted trees, I flattered myself that I had succeeded; but my old enemies, the moss and canker, in three years convinced me of my mistake. Some of them, however, trained to a south wall, escaped all their diseases, and seemed (like invalids) to enjoy the benefit of a better climate. I had before frequently observed, that all the old fruits suffered least in warm situations, where the soil was not unfavourable. I tried the effects of laying one kind, but the canker destroyed it at the ground. Indeed I had no hopes of success from this method, as I had observed that several sorts which had always been propagated from cuttings, were as much diseased as any others. The wood of all the old fruits has long appeared to me to possess less elasticity and hardness, and to feel more soft and spongy under the knife, than that of the new varieties

which I have obtained from seed. This defect may, I think, be the immediate cause of the canker and moss, though it is probably itself the effect of old age, and therefore incurable.

Being at length convinced that all efforts, to make grafts from old and worn out trees grow, were ineffectual, I thought it probable that those taken from very young trees, raised from seed, could not be made to bear fruit. The event here answered my expectation. Cuttings from seedling apple-trees of two years old were inserted on stocks of twenty, and in a bearing state. These have now been grafted nine years, and though they have been frequently transplanted to check their growth, they have not yet produced a single blossom. I have since grafted some very old trees with cuttings from seedling apple-trees of five years old : their growth has been extremely rapid, and there appears no probability that their time of producing fruit will be accelerated, or that their health will be injured, by the great age of the stocks. A seedling apple-tree usually bears fruit in thirteen or fourteen years ; and I therefore conclude, that I have to wait for a blossom till the trees from which the grafts were taken attain that age, though I have reason to believe, from the form of their buds, that they will be extremely prolific. Every cutting, therefore, taken from the apple (and probably from every other) tree, will be affected by the state of the parent stock. If that be too young to produce fruit, it will grow with vigour, but will not blossom ; and if it be too old, it will immediately produce fruit, but will never make a healthy tree, and consequently never answer the intention of the planter. The root, however, and the part of the stock adjoining it, are greatly more durable than the bearing branches ; and I have no doubt but that scions obtained from

either would grow with vigour, when those taken from the bearing branches would not. The following experiment will at least evince the probability of this in the pear-tree. I took cuttings from the extremities of the bearing branches of some old ungrafted pear-trees, and others from scions which sprang out of the trunks near the ground, and inserted some of each on the same stocks. The former grew without thorns, as in the cultivated varieties, and produced blossoms the second year; whilst the latter assumed the appearance of stocks just raised from seeds, were covered with thorns, and have not yet produced any blossoms.

The extremities of those branches, which produce seeds in every tree, probably shew the first indication of decay; and we frequently see (particularly in the oak) young branches produced from the trunk, when the ends of the old ones have long been dead. The same tree when cropped will produce an almost eternal succession of branches. The durability of the apple and pear, I have long suspected to be different in different varieties, but that none of either would vegetate with vigour much, if at all, beyond the life of the parent stock, provided that died from mere old age. I am confirmed in this opinion by the books you did me the honour to send me: of the apples mentioned and described by PARKINSON, the names only remain, and those since applied to other kinds now also worn out; but many of EVELYN's are still well known, particularly the red-streak. This apple, he informs us, was raised from seed by Lord SCUDAMORE in the beginning of the last century.* We have many trees of it, but they appear to have been in a state of decay during the last forty

* Probably about the year 1634.

years. Some others mentioned by him are in a much better state of vegetation ; but they have all ceased to deserve the attention of the planter. The durability of the pear is probably something more than double that of the apple.

It has been remarked by EVELYN, and by almost every writer since, on the subject of planting, that the growth of plants raised from seeds was more rapid, and that they produced better trees than those obtained from layers or cuttings. This seems to point out some kind of decay attending the latter modes of propagation, though the custom in the public nurseries of taking layers from stools (trees cropped annually close to the ground) probably retards its effects, as each plant rises immediately from the root of the parent stock.

Were a tree capable of affording an eternal succession of healthy plants from its roots, I think our woods must have been wholly over-run with those species of trees which propagate in this manner, as those scions from the roots always grow in the first three or four years with much greater rapidity than seedling plants. An aspin is seldom seen without a thousand suckers rising from its roots ; yet this tree is thinly, though universally, scattered over the woodlands of this country. I can speak from experience, that the luxuriance and excessive disposition to extend itself in another plant, which propagates itself from the root (the raspberry), decline in twenty years from the seed. The common elm being always propagated from scions or layers, and growing with luxuriance, seems to form an exception ; but as some varieties grow much better than others, it appears not improbable that the most healthy are those which have last been obtained from seed. The different degrees of health in our peach and nec-

tarine trees may, I think, arise from the same source. The oak is much more long-lived in the north of Europe than here; though its timber is less durable, from the numerous pores attending its slow growth. The climate of this country being colder than its native, may in the same way add to the durability of the elm; which may possibly be further increased by its not producing seeds in this climate, as the life of many annuals may be increased to twice its natural period, if not more, by preventing their seeding.

I have been induced to say a great deal more on this subject than, I fear, you will think it deserves, from a conviction that immense advantages would arise from the cultivation of the pear and apple in other counties, and that the ill success which has attended any efforts to propagate them, has arisen from the use of worn out and diseased kinds. Their cultivation is ill understood in this country, and worse practised; yet an acre of ground, fully planted, frequently affords an average produce of more than five hundred gallons of liquor, with a tolerably good crop of grass; and I have not the least doubt but that there are large quantities of ground in almost every county in England capable of affording an equal produce.

I have only to add an assurance, that the results of the foregoing experiments are correctly stated; and that

I am, Sir, &c.

Elton, Herefordshire,
April 13, 1795.

THO. AND. KNIGHT.